As a whole, the month was warmer than normal, with temperatures 90° or above at a few points in Arizona, California, Florida, and Texas. On the other hand, subzero temperatures were recorded at many places in the Rocky Mountain, Great Basin, and most northern border States, chiefly during the latter half of the month.

PRECIPITATION

The precipitation for the month was very unevenly distributed over the United States. Most of the lake region and Ohio Valley received more than the normal amount, while heavy to excessive falls, ranging in some cases from four to six times the normal, were received in parts of the southern Great Plains and lower Missouri Valley; the greatest November fall of record being measured at Kansas City and St. Joseph, Mo., Keokuk, Iowa, and Milwaukee, Wis. On the other hand, in the South the amounts were below the normal, except in the southern portions of Louisiana and Texas, where they were somewhat above, as also they were in most of California. Throughout the interior of the Atlantic States, the northwestern portion of the Great Plains, the northern Rocky Mountain region, and from the central portion of the Great Basin westward, except most of California, the precipitation was markedly deficient, many sections receiving less than 25 per cent of the normal, while in portions of the northwestern Great Plains and of southwestern Arizona no precipitation whatever was received.

SNOWFALL

No heavy snows occurred in the northern border States, but in the western mountains rather heavy falls were received in Colorado and portions of Nebraska, Wyoming, Utah, and New Mexico, and also in the eastern portion of California, while in portions of the Texas Panhandle unusually heavy falls for the season occurred about the middle of the month.

But little snow remained on the ground at the end of the month, except in the mountains of the West, the upper lake region, and northern portions of the New England States.

RELATIVE HUMIDITY

Over all interior and most western portions of the country the relative humidity was above the normal for the month, the values over the central Great Plains and Rocky Mountain regions being particularly high. Over the Atlantic and East Gulf States the average relative humidity was mainly less than normal and similar conditions prevailed along the immediate Pacific coast.

SEVERE LOCAL STORMS, NOVEMBER, 1928

[The table herewith contains such data as have been received concerning severe local storms that occurred during the month. A more complete statement will appear in the Annual Report of the Chief of Bureau]

Place	Date	Time	Width of path, yards	Loss of life	Value of property destroyed	Character of storm	Remarks	Authority
Floyd County, Iowa (Rock Grove Township).	14	4 p. m.			$2,000	Tornado	Character of damage not reported	Official, U. S. Weather Bureau.
Vinton, Benton County, to Silver Creek, Delaware County, Iowa.	14	4:30–5:15 p. m.		1	200,000	do	Scores of farmsteads demolished or damaged; much livestock killed; trees and telephone poles leveled; 9 injured.	Official, U. S. Weather Bureau; the Journal (Sioux City, Iowa).
Chester, Iowa	14	5:30 p. m.			3,000	do	Several buildings damaged; 2 persons injured	Official, U. S. Weather Bureau.
Wisconsin (eastern and southeastern).	14–15				10,000	High winds	Damage chiefly to overhead-wire systems, small farm buildings, windows, etc.	Do.
Orlando, Okla.	15	7 p. m.	220	2	10,000	Tornado	Several homes and barns wrecked; path 2 miles	Do.
Michigan (Thumb district).	15			1	25,000	Heavy gales	Farm buildings blown down; orchards uprooted.	Do.
Iowa (central and northeastern).	17					Snow and sleet	Overhead wires broken; poles snapped off; trees damaged.	Do.
Cumberland County, Pa.	19	2:30 p. m.				Wind	Considerable property damage reported	Do.
Chemung, Tioga, and Broome Counties, N. Y.	19	4–5 p. m.			120,000	do	Houses and barns unroofed; several barns demolished; livestock killed; heavy damage to manufacturing plant.	Do.
Wilkes-Barre, Pa., and vicinity.	19	4:30 p. m.			500,000	Probably tornado	Heavy damage to buildings, trees, etc	Do.
Montour and Columbia Counties, Pa.	19	P. m.				Wind	Scores of homes unroofed; communication cut off; highways blocked.	Do.
Rutland, Vt.	19	do				do	Wire communication interrupted; 2 automobiles demolished; poles blown down.	Daily News (Burlington, Vt.).

RIVERS AND FLOODS

By H. C. FRANKENFIELD

On the evening of November 15, 1928, a disturbance of apparent North Pacific origin was central over New Mexico. For the ensuing 36 hours it moved northeastward, and during this period it was attended by excessive rains over eastern Kansas, Missouri, eastern Iowa and northern Illinois, and the southern upper Lake region. Floods were, of course, inevitable, especially in the rivers of eastern Kansas and Missouri. They were especially severe in the Osage, Cottonwood, and Neosho Rivers of Kansas, and the following description thereof was prepared by Mr. S. D. Flora, meteorologist in charge of the Weather Bureau office at Topeka, Kans.:

Disastrous floods occurred along the Marais des Cygnes (Osage), Cottonwood, and Neosho Rivers as the result of downpours of 7 to 10 inches of rain that began during the night of November 15–16 and lasted approximately 36 hours. Such heavy rains were without precedent in Kansas so late in the year.

The total property damage in the basins of the three rivers was estimated at $1,948,000. Eight lives were lost—six in Franklin County, one in Miami County, and one in Labette County.

The greatest damage occurred in and near Ottawa, where the Marais des Cygnes reached a record breaking stage of 37.6 feet 13.6 feet above bankful, at 2 p. m. of the 17th. Fifty blocks of the city were covered by the flood waters. Seven hundred buildings were damaged, 30 houses washed away, and 40 others washed from their foundations. The municipal power plant and waterworks pumping plant were entirely disabled, leaving the city in darkness for several nights and without drinking water. Altogether, the water reached approximately 150 acres of land within the city limits. The damage in the city, exclusive to railways, was estimated at $200,000 by representatives of the United States Engineer Corps. On the same authority the total damage in Franklin County, of which Ottawa is the county seat, was estimated at $750,000, with an additional $200,000 damage to railways in and near Ottawa. Damage in Miami County was estimated at $400,000.

Damage to other counties in the basins of the three rivers was fairly well distributed and was mostly to bridges, highways, and

matured crops. Ottawa was the only city of considerable size that was seriously affected, though Quenemo and Burlington were heavy losers. Railway traffic was either entirely interrupted or seriously hampered for several days along the Neosho and Marais des Cygnes Rivers and a considerable amount of trackage washed out. Main highways were badly flooded in many places, making automobile travel impossible where the floods were highest.

Warnings for these floods were issued first on the morning of November 16, and frequently thereafter until the waters began to subside. Savings as a result of these warnings were reported as $130,000.

Crest stages and dates are given in the table at the end of this report.

The flood at the same time in the valley of the Walnut River, a small tributary of the Arkansas River, was relatively even more disastrous. The rainfall ranged from about 3.5 to 10.3 inches during the 36 hours and the waters soon overflowed the banks of the small stream. The flood came with great rapidity, one man in Winfield, Kans., reporting a rise in the river of about 5 feet in 23 minutes, while the river gage showed a rise from 8.4 feet at 5 p. m., November 16, to 40.1 feet at midnight of November 17–18, a total rise of 31.7 feet in 31 hours. Two square miles of the city of Winfield were covered, in some places to a depth exceeding 10 feet. Hundreds of families were rendered homeless temporarily, but suffering during the cold weather following was averted by the prompt action of the Red Cross and the local authorities.

Warnings of the floods were issued as soon as possible, but, owing to the rapidity of movement of the flood wave, the losses were heavy, about $965,000, of which $591,500 was in tangible property and $271,950 in crops. Of the entire loss, about $420,000 fell upon the city of Winfield. Savings accomplished through warnings were reported as $150,000.

In the Verdigris River at Independence, Kans., there was a crest stage of 43.5 feet, 13.5 feet above the flood stage, on November 19, but flood stages were not quite reached in the lower Verdigris and lower Neosho Rivers. Nevertheless, warnings were very helpful to bridge constructors and engineering and sand and gravel companies. Losses as reported amounted to $160,000 in Kansas, with 25,000 acres of land overflowed Crop losses were $43,000, and those of railroad and other real property $102,000. In Oklahoma the amount reached only about $25,000, with about 1,000 acres of land overflowed. Savings to sand and gravel companies through the warnings were about $25,000.

The Blue River, a small stream which passes through the extreme eastern portions of the city of Kansas City, Mo., also experienced a severe flood that drove 161 families from their homes and more or less covered a district about 12 miles in length from Swope Park to the junction of the Blue with the Missouri River. The flood was the greatest of record, reaching, on the morning of July 17, 47.5 feet above "normal" (probably low water) near the Seventy-first Street Bridge in Swope Park. This was 10 feet above the high-water marks of 1906 and 1927. No warnings were possible, and losses to business houses and homes amounted to $167,000.

The rainfall responsible for this flood amounted at Kansas City to 6.42 inches in about 33 hours.

Floods in the Osage and Grand Rivers of Missouri were forecast at the proper time, but, owing to the comparative frequence of floods during the present season, there was no damage to crops and none of much consequence to other industries.

There was also a moderate flood in the lower Missouri River and the Mississippi River from the Hannibal, Mo., district southward to Cape Girardeau, Mo., but apparently there was no damage except in the Hannibal district. The smaller rivers of northeastern Missouri were the highest within the memory of the oldest inhabitant, and the waters of the Fabius River caused a breach in the levee of the Marion County drainage district with the resulting overflow of about 4,000 acres of rich farm lands. There were also a few smaller breaks in the Lima Lake district of Illinois on the opposite side of the Mississippi River. No damage of consequence was done along the Mississippi River, except in the unprotected bottom lands and behind the levees mentioned above. Much shocked corn was carried away and standing corn was bent over and ruined. Crop losses amounted to $25,000, and other property losses, mainly to railroads, about $21,000. Reported value of property saved through the flood warnings, $50,000.

By the time the flood-producing rains of November 16–17 had ceased another storm from the West had reached Texas, and soon another heavy one-day rain period covered the southern Appalachian region, especially the mountain regions of southeastern Kentucky, the total rainfall ranging from about 2 to about 6 inches. The smaller streams, including the South Fork of the Kentucky River, were soon in severe flood, as was also the Cumberland River in Kentucky, and considerable damage was done. The losses along the South Fork of the Kentucky River and its tributaries were $70,100, of which $55,000 was in prospective crops.

Along the Cumberland River three lives were lost, and property damage and loss amounted to $186,500, of which $25,500 was in matured crops and $155,200 in tangible property.

River and station	Flood stage	Above flood stages—dates		Crest	
		From—	To—	Stage	Date
MISSISSIPPI DRAINAGE	*Feet*			*Feet*	
Cumberland: Williamsburg, Ky	22	20	22	22.6	Nov. 20
New: New River, Tenn	25	19	19	26.5	19.
Elk: Fayetteville, Tenn	14	19	21	18.3	19.
Mississippi:					
Quincy, Ill	14	18	22	17.5	19.
Hannibal, Mo	13	18	23	17.9	19.
Louisiana, Mo	12	18	24	17.3	20.
Grafton, Ill	18	21	24	19.8	23.
Alton, Ill	21	20	25	24.0	23.
Chester, Ill	27	22	25	27.9	24.
Cape Girardeau, Mo	30	22	26	31.5	24.
Illinois:					
Peru, Ill	14	18	[2]	15.9	20.
Pearl, Ill	12	22	26	13.2	24.
Missouri:					
Boonville, Mo	21	19	22	23.5	20.
St. Charles, Mo	25	20	25	27.75	22.
Grand:					
Gallatin, Mo	20	2	5	31.0	4.
		17	21	35.5	19.
Chillicothe, Mo	18	2	7	27.8	6.
		17	22	30.7	19.
Brunswick, Mo	12	17	24	18.0	21.
Thompsons Fork: Trenton, Mo	20	17	19	22.4	18.
Osage:					
Quenemo, Kans	30			[3] 38.3	17.
Ottawa, Kans	24			37.6	17.
Osceola, Mo	20	22	30	27.5	25.
Warsaw, Mo	22	20	29	28.1	24.
Tuscumbia, Mo	25	24	29	27.0	27.
Neosho:					
Neosho Rapids, Kans	22	17		27.3	18.
Le Roy, Kans	24	17	22	28.0	19.
Iola, Kans	15	17	23	21.0	20.
Chanute, Kans	20			28.3	21.
Parsons, Kans	22			27.5	24.
Oswego, Kans	17	19	28	25.3	24.
Cottonwood:					
Elmdale, Kans	32			34.2	17.
Emporia, Kans	20			27.0	17.
Verdigris: Independence, Kans	30	17	21	43.5	19.
Black: Corning, Ark	11	19	22	11.5	20.
WEST GULF DRAINAGE					
Guadalupe: Victoria, Tex	16	7	7	16.1	7.

[1] Continued from last month. [2] Continued at end of month. [3] Estimated.